

1 This is particularly important as ex-post (historical) total returns and equity risk premia
2 differ in size and direction over time. Absent the valuable insight of the prospect for
3 variance, and hence, risk, provided by the arithmetic mean, investors cannot
4 meaningfully evaluate prospective risk. Thus, the use of long-term historical data to
5 develop the total market return and resultant equity risk premium is entirely appropriate
6 for use in the RPM.

7 **Q. On page 38, lines 733 – 736 of ICC Staff Exhibit 7.0R, Mr. McNally asserts that**
8 **your beta adjusted approach to the RPM is a CAPM derivation. Please comment.**

9 A. Mr. McNally is again incorrect. The RPM and CAPM are two distinct models as
10 discussed in CIWC Exhibit No. 7, at pages 31, line 18 through page 32, line 4 wherein it
11 states the following:

12 While there are some similarities, there is a very significant distinction between
13 the two models. The RPM and CAPM both add a "risk premium" to an interest
14 rate. However, the beta approach to the determination of an equity risk premium
15 in the RPM should not be confused with the CAPM. Beta is a measure of
16 systematic, or market, risk, a relatively small percentage of total risk, i.e., the
17 sum of both non-diversifiable systematic and diversifiable unsystematic risk.
18 Unsystematic risk is fully captured in the RPM through the use of the prospective
19 long-term bond yield as can be verified by reference to pages 3 through 9 of
20 Exhibit No. 7, Schedule 2, which confirm that the bond rating process involves
21 an assessment of all business and financial risks. In contrast, the use of a risk-
22 free rate of return in the CAPM does not, and by definition can not, reflect a
23 company's specific, i.e., unsystematic risk. Consequently, a much larger portion
24 of the total common equity cost rate is reflected in the company-specific bond
25 yield (a product of the bond rating) than is reflected in the risk-free rate in the
26 CAPM, or indeed even by the dividend yield employed in the DCF model.
27 Moreover, the financial literature recognizes the RPM and CAPM as two
28 separate and distinct cost of common equity models as discussed previously.
29

30 As indicated above, the financial literature recognizes the RPM and CAPM as
31 two distinct cost of common equity models. Schedule 7 presents the Table of Contents
32 from Regulatory Finance – Utilities' Cost of Capital, by the previously mentioned Dr.
33 Morin. It is clear from the Table of Contents that the RPM and CAPM are two separate
34 and distinct models since Dr. Morin devotes a separate chapter to each model.

Moreover, Dr. Morin also indicates that it is entirely appropriate to adjust the market equity risk premium by beta for use in the RPM when he states:

"The risk premium estimate derived from a composite market index must be adjusted for any risk differences between the equity market index employed in deriving the risk premium and a specified utility common stock. Several methods can be used to effect the proper risk adjustment.

First, the beta risk measure for the subject utility or the beta of a group of equivalent risk companies can serve as an adjustment device. The market risk premium RP_M , is multiplied by the beta of the utility, β_U , to find the utility's own risk premium, RP_U :

$$RP_U = \beta_U RP_M$$

and the beta-adjusted risk premium is added to the bond yield to arrive at the utility's own cost of equity capital."⁸

Q. Mr. McNally also asserts that you have applied market risk premium-based betas to a non-market risk premium (page 39, line 744 through page 40, line 764 of ICC Staff Exhibit 7.0R). Please comment.

A. First, Mr. McNally states at lines 744-747 on page 39 of ICC Exhibit No. 7.0R that Value Line betas are "developed by regressing each company's excess returns over the risk-free rate . . . against the excess returns of the market over the risk-free rate." Again, Mr. McNally is incorrect. As previously discussed and clearly indicated on Schedule 1 of CIWC Exhibit No. 7 accompanying this testimony, Value Line betas are not calculated using excess returns, rather they are calculated using price relatives, i.e., price changes.

Second, Mr. McNally states that "[b]eta measures relative market risk and cannot be assumed to accurately measure any other type of risk." (lines 740 – 750, page 39, ICC Staff Exhibit 7.0R). Mr. McNally is entirely correct. As previously stated in both this and my direct testimony, beta is a measure of systematic, or market, risk which is a relatively small percentage of total risk. However, company specific, unsystematic, non-

⁸ Roger A. Morin, Regulatory Finance – Utilities' Cost of Capital, Public Utilities Reports, 1994, p. 283.

1 market, risk is fully captured in the RPM through the use of a prospective company
2 specific long-term bond yield. In contrast, the use of a risk-free rate of return in the
3 CAPM does not, and by definition can not, reflect unsystematic, non-market, company-
4 specific risk. Consequently, the RPM does not overestimate the common equity cost rate
5 for all companies with betas less than one. Rather it is the CAPM underestimates the
6 common equity cost rate for all companies with adjusted betas less than 1.00 because it
7 does not capture unsystematic, non-diversifiable, company-specific risk. For this reason,
8 and because no cost of common equity model is inherently precise, it is imperative,
9 logical, and consistent with the EMH, that rate of return analysts employ multiple cost of
10 common equity models in an attempt to emulate investor behavior.

11 **Q. At page 40, line 768 through page 41, line 794 of ICC Staff Exhibit 7.0R, Mr.**
12 **McNally comments upon your use of historical and projected bond yields in your**
13 **application of the RPM. Please comment.**

14 **A.** Mr. McNally's algebraic manipulations of my application of the RPM needlessly
15 complicate the model and demonstrate Mr. McNally's misunderstanding of it. The 8.3%
16 yield referenced on page 41, line 786 is the prospective yield on A rated public utility
17 bonds. The 5.9% yield referenced on the same line is the historical, long-term yield on
18 corporate bonds used to derive the arithmetic mean market equity risk premium. The
19 7.7% yield referenced on line 787 is the prospective yield on corporate bonds used to
20 derive the forecasted market equity risk premium. Hence, R_{A2} should be 6.8%, the
21 average of 5.9% and 7.7%, the historical and prospective yield on corporate bonds. The
22 financial literature is consistent that when estimating equity risk premia, the market
23 returns and the bond yields employed should cover the same time period. Hence, it is a
24 mismatch to derive an historical equity risk premium by using a forecasted bond yield or
25 even an average of the forecasted and historical bond yield. Mr. McNally's algebraic

1 manipulations thus obfuscate the simplicity of the model and are in direct violation of the
2 financial literature on equity risk premia estimation.

3 Again, what, we, as rate of return analysts are attempting to do is to emulate
4 investor behavior. All the components we use in the application of cost of common
5 equity models are but proxies for investor expectations. Financial theory is just that –
6 theory. Any theory, financial or otherwise, is only as good as the assumptions which
7 underlie it and how well they comport with reality. Hence, when one applies theoretical
8 models such as the DCF, RPM, CAPM or CEM, using real world observations / data one
9 is using proxies for the theoretical components of the models. It is precisely because we
10 use proxies for investor expectations that no model is so inherently precise that it should
11 be relied upon exclusively in a cost of common equity determination.

12 **Q. Please discuss Mr. McNally's assertion that the equity risk premium developed**
13 **based upon the holding period returns of public utility stocks “was improperly**
14 **derived.” (page 41, line 797 through page 42, line 821).**

15 A. First, I did not “select” the time period of 1928-1999 for the estimation of the equity risk
16 premium. S&P Utility Index data only exist beginning in 1928. Therefore, the 1928-
17 1999 period represents all the years for which data were available. Previously discussed,
18 it is appropriate to use long-term historical data in a cost of common equity determination
19 because while specific historical events may not be repeated in the future, the event-types
20 and their effects will be.

21 Second, an overstatement of 20 basis points, i.e., the difference between 4.6%
22 and 4.4%, is irrelevant to both the final results of my application of the RPM and my
23 final recommendation of common equity cost rate applicable to CIWC. A 4.4% equity
24 risk premium results in a slightly lower, by 10 basis points, RPM result, with no change
25 to my conclusion of common equity cost rate of 11.85% for CIWC and no change to my

1 conclusion that the Company's requested return rate on common equity of 11.00% is
2 conservatively reasonable.

3 Third, while it is true that my second equity risk premium derivation is based
4 upon the S&P Public Utility Index, by adjusting the resulting equity risk premium based
5 upon the Index to reflect the yields on A rated public utility bonds, the equity risk
6 premium is applicable to the proxy group of six water companies which was selected
7 based upon similar, albeit less, risk to CIWC. And, since, the proxy group of six water
8 companies is less risky than CIWC, as demonstrated throughout both my direct and
9 rebuttal testimonies, as well as Mr. McNally's assertion that utilities with A rated bonds,
10 such as the proxy companies, are less risky than CIWC, the equity risk premium based
11 upon the holding period returns of the S&P Public Utility Index understates the equity
12 risk premium applicable to CIWC.

13 F. Comparable Earnings Model

14 **Q. Mr. McNally describes the "shortcomings" of your CEM analysis on page 42, line**
15 **825 through page 44, line 866 of ICC Staff Exhibit 7.0R. Please comment.**

16 **A.** Mr. McNally criticizes my use of historical data despite an absence of evidence contrary
17 to my assumption that investors utilizes all data, historical and projected, available to
18 them, consistent with the EMH, particularly as to water utilities for the reasons discussed
19 previously.

20 Second, different accounting practices (line 826, page 42 through line 835, page
21 43) also affect the growth rate component, projected or historical, of the DCF model.
22 Moreover, because the criteria used to select the non-utility companies in my application
23 of the CEM are based upon total risk, i.e., the sum of non-diversifiable, market, risk and
24 diversifiable, non-market or company-specific, risk, all impacts of accounting differences
25 have been obviated. Hence, accounting differences between the different industries are
26 irrelevant.

1 Third, because the selection of non-price regulated firms of comparable risk is
2 based upon statistics derived from the market prices paid by investors my application of
3 the CEM is market based. And since the rates set in this proceeding will be applied to the
4 original, depreciated cost, or book, rate base of CIWC, it is reasonable to assume that a
5 combination of realized and expected returns on book value are an appropriate estimate
6 for investor required returns on book value (page 43, lines 835 – 839). As stated in
7 CIWC Exhibit No. 7, my direct testimony, at page 44, lines 6 – 9:

8 “The CEM is designed to measure the returns expected to be earned on the book
9 common equity, in this case net worth, of similar risk enterprises. Thus, it
10 provides a direct measure of return, since it translates into practice the
11 competitive principle upon which regulation rests.”
12

13 In other words, the CEM is based upon the fundamental economic principle of
14 opportunity cost where the true cost of an investment is equal to the cost of the best
15 available alternative use of the funds to be invested, consistent with the fundamental
16 regulatory principle that regulation is intended to act as a surrogate for competition and to
17 provide a fair rate of return to investors. Thus, the CEM is consistent with the
18 “corresponding risk” standard established in the landmark cases of the U.S. Supreme
19 Court, namely the Hope⁹ and Bluefield¹⁰ cases upon which rate base / rate of return
20 regulation rests. As stated in Bluefield in 1922:

21 “A public utility is entitled to such rates as will permit it to earn a return . . . on
22 investments in other business undertakings which are attended by corresponding
23 risks and uncertainties . . . “
24

25 In addition, the U.S. Supreme Court stated in Hope in 1944:

26
27 “By that standard the return to the equity owner should be commensurate with
28 returns on investments in other enterprises having corresponding risks.”
29

30 Thus, my application of the CEM does not incorrectly imply that the rate of
31 return on book common equity is equivalent to current investor-required rates of return,

⁹ Federal Power Commission v. Hope Natural Gas Co., 320 U.S. 591 (1944).

1 presumably on market price. (page 44, line 855-856, ICC Staff Exhibit 7.0R).
2 Interestingly, this is precisely the implication of applying a market data derived common
3 equity cost rate, such as that derived using the DCF, to a book value rate base, especially
4 when market to book ratios differ significantly from one. Mr. McNally is indeed correct
5 that there is "no basis for that implication since the accounting return that the comparable
6 earnings method measures may be more or less than the return investors require from an
7 investment." (page 44, lines 857-859, ICC Staff Exhibit 7.0R) This is precisely why
8 applying a DCF based common equity cost rate range, such as Mr. McNally's
9 recommended range of common equity cost rate of 9.90% to 10.40% to CIWC's book
10 value rate base will understate the investors true required rate of return since market to
11 book values are currently well in excess of one as is discussed in CIWC Exhibit No. 7 at
12 page 20, line 13 through page 23, line 16 and illustrated in Schedule 8 of Exhibit No.
13 7.0R

14 Fourth, at page 43, lines 839 – 842, Mr. McNally claims that my two non-utility
15 proxy groups are riskier than the proxy groups of utilities they represent. He cites the
16 difference in the average beta of the proxy group of six water companies of 0.53 relative
17 to the average beta of the comparable non-utility proxy group of 0.64, an 11 basis points
18 difference. Likewise, he cites the difference in the average beta of the proxy group of
19 comparable utilities of 0.57 relative to the average beta of the comparable non-utility
20 proxy group of 0.67, a 10 basis points difference. Schedule 8 of Exhibit No. 7
21 accompanying this testimony shows the current Value Line adjusted betas for the
22 companies covered by Value Line (Standard Edition) in both of Mr. McNally's
23 comparable samples. As can be gleaned from Schedule 8, American States Water Co.
24 has a beta of 0.65 and American Water Works Co., Inc. has a beta of 0.55, a 10 basis
25 points difference. Using Mr. McNally's logic, these companies should not be part of the

¹⁰

Bluefield Water Works Improvement Co. v. Public Serv. Comm'n, 262 U.S. 679 (1922).

1 same sample group because they are not of similar risk. As can also be gleaned from
2 Schedule 8, Constellation Energy Corp. has a beta of 0.50, while Kansas City Power and
3 Light Co. has a beta of 0.60, again, a 10 basis points difference. And, likewise, based
4 upon Mr. McNally's logic, the two companies are not of similar risk. Yet, curiously, Mr.
5 McNally's comparable sample companies were selected for inclusion in the sample
6 because of similar, albeit unnamed, risk factors. Since both of my proxy groups of non-
7 utility companies were selected based upon criteria of similar risk to either the water
8 company group of the comparable utility group, the companies comprising the proxy
9 groups of non-utility companies are indeed of similar risk.

10 **G. Size Based Risk Premium**

11 **Q. On page 45, lines 873-875 of ICC Staff Exhibit 7.0R, Mr. McNally states that if any**
12 **size based risk premium were to be added to a common equity cost rate applicable**
13 **to CIWC it should be based upon the size of PSC, CIWC's parent. Please comment.**

14 **A.** Mr. McNally is incorrect because he ignores a basic financial precept, i. e., the risk rate
15 (return rate) is related to the asset in which capital is invested. Under the rate base / rate
16 of return paradigm, it is the rate base of the regulated entity to which a rate of return set
17 in a regulatory proceeding will be applied. In short, it is CIWC's rate base, and the risk
18 of investing therein which is 'the asset' for which the rate of return (and risk) must be
19 compatible. This means that the rates set in the instant docket will be applied to CIWC's
20 rate base and CIWC's rate base alone. Therefore, it is the risk to which investment in this
21 rate base, and no other, is relevant. The relationship of the regulated company and its
22 parent company is irrelevant. Only the riskiness of the regulated company's rate base is
23 relevant in determining an appropriate rate of return for the Company. The identity of the
24 owner(s) of the stock in question is irrelevant. For example, if I own stock in XYZ
25 Company, my required rate of return on my investment in XYZ is based upon the
26 riskiness of XYZ and my preference for risk - nothing else. If I sell my stock in XYZ to

1 Mr. McNally, for instance, his required rate of return on his investment in XYZ will be
2 based upon the riskiness of XYZ and his preference for risk. However, this transfer of
3 ownership from myself to Mr. McNally would change nothing regarding XYZ's inherent
4 riskiness upon which the required rates of return must be XYZ is based. Likewise,
5 CIWC's ownership by PSC, through Consumers Water Company, changes nothing about
6 the riskiness of CIWC and its rate base. As a result of the acquisition of Consumers
7 Water by PSC, there has been no change in CIWC's number of customers, customer mix,
8 day-to-day operating environment, size, or capital needs, and therefore, no change in its
9 inherent risk. Consequently, it is not appropriate to base a size premium applicable to
10 CIWC upon the size of PSC.

11 **Q. On page 45, lines 877-890 of ICC Staff Exhibit 7.0R, Mr. McNally gives several**
12 **reasons why a size based risk premium should be based upon PSC. Please address**
13 **them.**

14 A. First, at lines 880-882 on page 45, Mr. McNally claims that "[b]eing a part of a much
15 larger organization should enhance the ability of CIWC to access the market on
16 reasonable terms." Yet, he has provided no evidence that the capital attraction position of
17 CIWC has been enhanced by PSC ownership of CIWC. In fact, the Company informs
18 me that in negotiations with potential lenders, there is no interest in the relationship
19 between the Company and PSC, but rather an interest in the ability of CIWC and CIWC
20 alone to service any additional debt.

21 Second, at lines 882-884, page 45 of ICC Staff Exhibit 7.0R, Mr. McNally states
22 that "reductions in costs resulting from efficiencies should be passed on to customers in
23 the form of lower rates." The statement is true, but such cost reductions will be reflected
24 in the operating expenses component of the revenue requirement. Hence, ratepayers will
25 not be "denied the benefits associated with the combined entity's stronger financial
26 profile." (lines 889-890, page 45).

1 It is clear, then, CIWC stands alone in the fixed capital markets and any
2 reduction in PSC's cost of capital because of the acquisition is irrelevant to CIWC's
3 investment risk and hence, the risk of the rate base to which rates set in this proceeding
4 will be applied. Furthermore, the opportunity cost principle means that a prudent,
5 rational investor, including a parent company, will look elsewhere to invest his / her
6 money unless the riskiness inherent in the asset, i.e., CIWC's rate base is justly and fairly
7 compensated regardless of who owns the asset or how many investors there are.
8

9 **Q. On page 46, line 1 through page 50, line 988, Mr. McNally discusses the lack of a**
10 **theoretical basis for a size based risk premium. Please comment**

11 A. A "theoretical" basis is not necessary in the face of common sense and empirical
12 evidence. The phenomenon of the effects of size on risk is directly observable in the
13 marketplace. Schedule 9 is the excerpt from Eugene F. Brigham's book, Fundamentals
14 of Financial Management, 5th Ed., cited on page 12 of CIWC Exhibit No. 7, my direct
15 testimony. It is clear from Schedule 9 that many of the factors discussed by Mr. McNally
16 at page 46, lines 896-904 of ICC Staff Exhibit No. 7.0R, i.e., lack of liquidity and
17 transaction costs, increase the riskiness of small firms. In fact, in my opinion, these
18 possibly are very good "theoretical", but certainly common sense, reasons for the greater
19 risk occasioned by small size. Moreover, the fact that Dr. Brigham does not specifically
20 refer to utilities (page 46, line 913 through page 47, line 1) is irrelevant. Financial theory
21 is applicable across the broad spectrum of firms and not limited to any particular industry
22 or industries. Schedule 10, is an excerpt from Ibbotson Assoc. Valuation Edition – 2000
23 Yearbook regarding Firm Size and Return. On page 133 they state:

24 "One question regularly raised concerning the size premium is whether it is
25 relevant for specific industries. In the past there has been no concrete evidence
26 to counter the contention that a size effect exists for the economy as a whole but
27 may not be relevant to a specific industry. The problem of supporting a size

premium for a specific industry has been made difficult by a lack of data for companies in individual industries.

* * *

We have attempted to answer this question by performing an industry-specific size effect study. . . . The results of the study can be found in table 5-11. Note that almost all industries exhibit returns where small company stocks outperform large company stocks over extended period.”

The two digit SIC (Standard Industrial Classification) code for utilities is 49.

Table 5-11 on page 137 of Ibbotson Assoc. Valuation Edition – 2000 Yearbook, clearly indicates that the small size premium is applicable to utilities.

It is also true that the Ibbotson Assoc. study is based upon the stocks in the New York Stock Exchange (NYSE). In fact, the majority of the utilities in Mr. McNally's two sample groups are listed on the NYSE, including PSC, CIWC's parent company as shown on Schedule 5.

In view of the foregoing, the basis of my size-based risk premium is not questionable. If it is questionable, it is only questionable in terms of magnitude for while the Ibbotson Assoc. study indicates that an appropriate small size risk premium for Micro-cap stocks, with an average market capitalization of \$97.0 million, still somewhat larger than CIWC's estimated market capitalization of \$82.1 million, is 2.21% or 221 basis points, my adjustment for CIWC's small size was a modest and very conservative 0.20%, or 20 basis points.

Q. On page 50, at lines 980-982, Mr. McNally states that my “application of a size-based risk premium, on the basis of Ibbotson Associates’ historical size-based risk premiums, is probably inconsistent with the manner in which Ibbotson Associates measured the historical size-based risk premiums.” Please comment.

A. Once again, Mr. McNally is incorrect. Ibbotson Assoc.'s size-based risk premia are based upon an analysis using adjusted betas. Footnote 3 of page 118 of Ibbotson

1 Assoc.'s Valuation Edition – 2000 Yearbook (see Schedule 10 of Exhibit No. 7.0R)
2 describes how Ibbotson Assoc. calculated the betas it used in its size-based risk premia
3 analysis. Footnote 3 also refers to Chapter 4 of the Valuation Edition – 2000 Yearbook
4 for “more detail on beta estimation.” Chapter 4 clearly states that the betas which
5 Ibbotson Associates use in their various studies are adjusted betas. Hence, my
6 application of a size-based risk premium is not inconsistent with Ibbotson Associates’
7 historical size-based risk premia, except to the extent that it is extremely conservative.
8

9 **Q. On page 50, line 991 through page 51, line 1023 of ICC Staff Exhibit 7.0R, Mr.**
10 **McNally states that it is not appropriate to apply a size-based risk premium to a**
11 **composite cost of common equity, based upon the DCF, RPM, CAPM and CEM.**
12 **Please comment.**

13 A. First, Mr. McNally is correct when he states on page 50, lines 997-999 that a size-based
14 risk premium would be reflected in the stock price parameter of a DCF analysis.
15 However, in the instant docket, since the common stock of CIWC is not traded, both Mr.
16 McNally and myself must look to proxy companies whose common stock is traded for
17 insight into a cost of common equity applicable to CIWC. The size of the companies in
18 Mr. McNally's two sample groups is reflected in their market prices and hence, in their
19 DCF derived cost rates of common equity. But, as demonstrated previously in this
20 testimony and on Schedule 5, the average book capitalization of Mr. McNally's two
21 sample groups at June 30, 2000 was 7.3 times and 26.7 times larger than CIWC's
22 capitalization of \$82.145 million, respectively. Hence, CIWC's small size is not
23 reflected in the DCF derived common equity cost rates based upon the market data of his
24 sample group companies.

25 Second, it is appropriate to apply a size-based risk premium to a CAPM derived
26 cost of common equity. Mr. McNally assumes, in error, that investors seek compensation

only for market risk. (page 51, lines 1010-1012) That is only true in the context of a portfolio of securities. However, in the instant docket the goal is to establish the cost of common equity of a single security where non-market risk, including increased risk due to small size, is extremely important to investors.

In view of all of the foregoing, a size-based upward risk adjustment is empirically supported and appropriately applicable to small utilities, such as CIWC.

Q. Does that conclude your testimony?

A. Yes.

EXHIBIT NO. 7.0R

CONSUMERS ILLINOIS WATER COMPANY

DOCKET NO.

EXHIBIT

TO ACCOMPANY THE

REBUTTAL TESTIMONY

OF

PAULINE M. AHERN, VICE PRESIDENT
AUS CONSULTANTS - UTILITY SERVICES

CONCERNING

COMMON EQUITY COST RATE

SEPTEMBER 28, 2000

BETA (FIELD 238)

The Value Line Beta is a standard measure of price volatility. Generally, Beta is calculated using one of two methodologies. Value Line Beta's are calculated using the New York Stock Exchange Composite as the "market" proxy, (259 observations) and is derived from a least-squares regression analysis between weekly percent changes in the price of a stock and weekly percent changes in the New York Stock Exchange Composite Index over a period of five years. All prices are adjusted for stock splits and stock dividends. Cash dividends are not included in the calculations. For example, a Beta of 1.50 would indicate that a stock has historically tended to rise (or fall) 50% more than the stock market as a whole. In theory, this relationship should persist in future periods. Theory and practice are not necessarily identical, however, and many questions remain about the ability of historical Betas to predict subsequent stock price changes relative to the market. Users may wish to refer to "*A Comparison of Published Betas*," Reilly & Wright, *Journal of Portfolio Management*, Spring 1988.

There has been a tendency over the years for high Beta stocks to become lower and for low Beta stocks to become higher. This tendency was measured by studying the Betas of stocks in consecutive five-year intervals. The Value Line Betas are adjusted for this tendency, by the formula: $\text{adjusted Beta} = .35 + .67 * \text{calculated Beta}$.

Value Line uses the New York Stock Exchange Composite, which is used as the measure of the general market. The New York Stock Exchange Composite is used as a basis for calculating Beta, because this index is a good proxy for the complete equity portfolio. Since Beta's significance derives from its usefulness in portfolios rather than individual stocks, it is best constructed by relating to an overall market portfolio. Betas are suitable as measures of portfolio risk since the non-market risks of stocks in a diversified portfolio often cancel one another out. The Standard Deviation is a better measure of the risk of holding a single stock.

BETA'S R FACTOR (FIELD 248)

This is the coefficient of correlation for the Beta. It describes the percentage of a stock's variability that may be attributed to systematic (i.e., market) risk. The average R is about .50.

STANDARD DEVIATION (FIELD 239)

The Standard Deviation is a measure of the total volatility or risk in a stock including both market sensitivity and a stock's inherent instability.

ALPHA (FIELD 237)

The average number of basis points per week by which the stock has outperformed, on a price basis, (or in the case of a negative number, underperformed) the New York Stock Exchange Composite Average over the past five years. It is derived from a least-squares regression analysis between weekly percentage changes in the price of the stock and weekly percentage changes in the NYSE Composite Average. Stocks with a price history of less than five years will have an alpha calculated only if there are at least 100 weeks of price data available.

Alpha is the part of a stock's total return that cannot be explained by Beta. Both Alpha and Beta are totally price driven in that financial fundamentals are not taken into account.





Merrill Lynch

Schedule 2
Page 1 of 6

Security Risk-Evaluation Service

DESCRIPTION OF MERRILL LYNCH BETA COEFFICIENTS

This booklet explains the terms used and describes the concepts and computational procedures followed in calculating the Merrill Lynch betas.

BASIC PROCEDURE

Merrill Lynch computes betas on individual securities by means of regression analysis. The analysis provides a description of the relation between monthly price returns on an individual stock and monthly price returns on the Standard & Poor's 500 Stock Index. The chart shows a scatter diagram of returns on an individual security plotted against returns on the S & P 500. Each point in the chart represents the realized price return on the stock and on the S & P 500 Index for a single month.

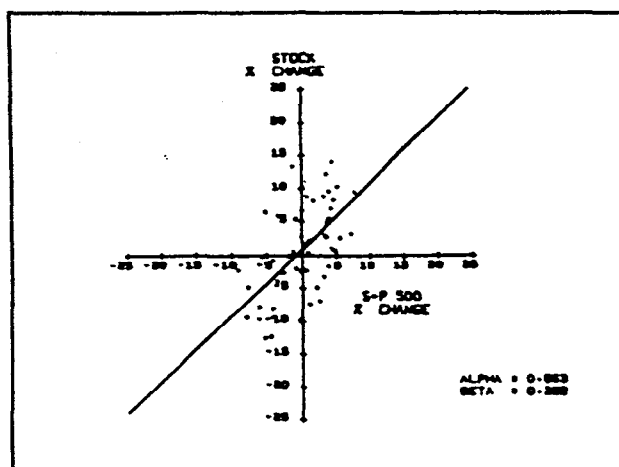
Because of the comovement between stock returns and returns on the S & P 500, the points usually form a pattern that is best described by a straight line. Regression analysis determines which straight line best approximates the observed points. In mathematical terms, that line is the one for which the sum of the squared distances between the points and the line is smallest, i.e., a "least squares" regression estimate.

TERMINOLOGY

The beta coefficient of stock is the slope of the regression line. The beta represents the average incremental percentage change in return (positive or negative) on the stock in relation to an incremental 1% change in return (positive or negative) on the S & P 500. Securities with high-

er betas are more sensitive to market fluctuations because, on average, they gain (or lose) more when the S & P 500 rises (or falls). The alpha coefficient is the intercept of the line; i.e. the height of the line at the point where the S & P 500 return is zero (see chart).

Because the price of a stock is affected by events peculiar to the company as well as by the market fluctuations indicated by the S & P 500, the actual points are not on the line, but are scattered around it. Residual standard deviation is a summary measure of the distances from the points to the line. Statisticians often refer to it as the "standard error of estimate." Residual standard deviation is important because it measures a security's specific (or non-market) risk. The greater a particular stock's residual standard deviation, the greater the effect on its price of events specific to the company's operations.



Using past results to determine a straight line (to estimate an alpha and beta) is subject to statistical error. For example, if returns on a stock were observed for an extended time and separate regression analyses were made for each of several sub-periods, different values of alpha and beta would almost certainly be computed from each regression, even if the market sensitivity and probability distribution of specific returns were unchanged. The values would differ because realized specific returns are independent of the market and would therefore have varying effects on the results of the regression. The standard error of estimate on alpha or beta is a measure of possible divergence of the estimate from the true value.

The r^2 statistic represents the percentage of price fluctuations of a security explained by market fluctuations. Mathematically, r^2 is the ratio of the variance of explained returns to the variance of total return for the stock.

STABILITY OF BETA AND ALPHA

To be useful, the beta measurements must indicate the future market sensitivities of individual securities. Among researchers who have studied the stability of beta coefficients are Marshall Blume, Lawrence Fisher, Michael Jensen, Robert Levy, and William Sharpe. Most of their research involved measuring and comparing betas on individual stocks and on randomly selected portfolios during pairs of non-overlapping time periods. Although a relation was found between betas for individual stocks during successive time periods (stocks with high betas in one period tended to have high betas in the next), betas for many stocks appeared to differ significantly from one period to the next. There are at least two explanations for the variations. Any estimated beta is affected by statistical or sampling error; therefore, observed differences between pairs of estimated betas, both subject to error, can be larger than the differences between actual betas. Changes do occur in the actual values of some stock betas and further intensify observed differences.

When portfolios were analyzed, the results were considerably more satisfying. Because specific returns on a group of stocks tend to balance one another and the law of large numbers takes hold, statistical errors in computing a portfolio beta are significantly smaller. If betas for some stocks in a portfolio actually

change, stocks with increased betas are balanced by others with decreased betas. Consequently, portfolio betas computed for one period closely resemble the betas computed for the succeeding period. The research on portfolios supports the contention that a beta computed on a portfolio has excellent predictive value. Primary studies supporting that result include those of Black-Jensen-Scholes, Sharpe and Cooper, and others.

The alpha coefficient is an indicator of how well a stock has performed, after the market effect has been eliminated, during the previous five years. Testing during non-overlapping periods has shown that ex ante alphas are not indicative of ex post alphas. If alphas were stable, investors would choose to hold only stocks with high alphas and, by doing so, would bid up their prices and thus eliminate any stability. It is precisely that action in the marketplace that causes alphas to have an expected value of zero.

Even though alphas have no predictive value for individual stocks, that does not preclude their usefulness in measuring past performances of managed portfolios, if they are based on actual portfolio returns. Correctly measured portfolio alphas are a useful estimate of the manager's ability in selecting securities.

METHOD

There are several alternative procedures for calculating betas, and several alternative data sources are available. A primary consideration in choosing the Merrill Lynch method was the extent to which given procedures had been tested both in the academic and financial communities.

Merrill Lynch chose standard-regression estimates because no empirical evidence has shown other methods to be superior statistically. In standard regression, recent returns carry no more weight than earlier returns. Because betas for many stocks probably change over time, methods that favor recent information have intuitive appeal. Some methods "smooth" data to allocate more weight to current information. Exponential smoothing is one method that weights new data more heavily, but applies the same smoothing constant to all data. A method based on Kalman Filtering adjusts the smoothing constant continuously to alter the weight given to new data. The weight is based

on a series of tests designed to determine how significantly new information differs from older data. Selecting the "best" smoothing constant is difficult in either case; and, in the case of betas, the selection process is complicated by the need to use different constants for different stocks. If the wrong smoothing constant is used, the procedure may phase out early information too quickly, or give too much weight to obsolete data.

Tests conducted by Dr. Lawrence Fisher of the University of Chicago showed that certain exponential-smoothing constants produced betas for some stocks that were slightly more reliable predictors than those attained by standard regression. The improvement, however, was not great enough statistically to warrant the use of that method. Research on Kalman Filtering looks promising, but experiments have been restricted to stocks on which monthly data on returns is available for significantly more than five years. Kalman Filtering is described in an article written by Dr. Michael Kantor of Merrill Lynch in the January-February 1971 edition of the *Financial Analysts Journal*. Those and other procedures are currently being tested by Merrill Lynch. If subsequent testing shows such new methods to be superior, they will be incorporated into the Merrill Lynch service.

Monthly differencing intervals were chosen for the Merrill Lynch service. That method provides a large number of observations during a five-year period, and it is the method that has been most thoroughly tested. Merrill Lynch funded the development of the original data base—the rate of return files of the Center for Research in Security Prices of the University of Chicago—on which much of the testing of the beta concept was performed. The files contain monthly returns on NYSE-listed stocks from 1926 through 1966. (An update to include data through the present time is almost complete.)

Annual and quarterly returns were rejected because too few observations were available. Daily returns are appealing because they permit the largest number of observations to be used within a given time. Nonetheless, use of daily returns could create serious problems—in particular, the so-called "Fisher effect." Daily closing prices are not established at precisely the same time of day (the close of trading), but are the prices at which each stock was last

traded during each day. If trading in a particular stock is light, the closing price may reflect an early trade that was unaffected by changes in the market level later in the day. Because daily percentage changes are usually small, an apparently slight market change later in the trading day might be significant. Further research is under way to determine whether serious bias does exist in daily returns. If the bias is less severe than is now supposed, or if methods can be developed to overcome the biases, daily returns data might replace the monthly information now in use.

Similar problems pertain to weekly data, although the biases differ as does the extent of testing. In general, weekly data in machine-readable form are available for a significant number of stocks only since 1962. Therefore, truly effective empirical evaluations of weekly data may not be made for some time.

In the calculations, returns on the stocks and on the S & P 500 are represented by percentage price changes, excluding dividends. Studies have shown that betas based on simple price returns are almost identical to those based on total returns (prices and dividends). A study by Sharpe and Cooper at Stanford University showed that the r^2 on regressions of total-return betas against price-return betas is above .99. Because dividends are usually stable, it can also be shown that the two methods yield statistically, as well as empirically, an almost identical beta. Although monthly price returns are available within a few days after the end of each month, dividends information is not so readily available, and collection of total-returns data would be considerably delayed. Merrill Lynch believes that the immediate availability of returns excluding dividends outweighs the alleged superiority of returns including dividends.

In recent months certain adjustments to the betas have been suggested, and some would appear to be beneficial. The adjustments allow for recognition of the phenomenon called regression bias. Because of random statistical error, the betas of many stocks with high observed betas really have been overestimated, and few have been underestimated. For example, if all stocks had betas between 0 and 2, any stock with an observed beta of two could only be biased upward. All stocks that appeared to have a beta of two would either really

have a beta of two or a lower beta with an upward measurement error. Therefore, the best predicted beta for the over-all group of stocks with an observed beta of two could be somewhat less than two. The same principle holds in actual beta calculations. Generally, a group of stocks with a high observed beta includes more issues whose beta values are overestimated than underestimated so that the future beta of this group of stocks will be lower than was observed. The reverse applies to stocks with low observed betas. Consequently, expected future betas on all stocks tend to move in the direction of one from their calculated values.

In an article in the March 1971 issue of the *Journal of Finance*, Marshal Blume offered one approach to the problems of regression bias: he computed betas on a group of stocks during two consecutive non-overlapping time intervals and regressed first-period betas against later betas. When the resulting regression equation was applied to the earlier betas, the best estimators, by definition, of subsequent betas were produced. If the relation between ex ante and ex post betas is constant, applying such regression equations to current betas should improve the predictive value of those betas. Testing supports that contention.

An alternative adjustment makes use of an empirical Bayesian approach to determine the amount of measurement error in the population of betas. One makes an a priori assumption that all betas are equal to one. Using the statistical error information (standard error of beta) provided by the regression, it is possible to gauge the over-all accuracy of the betas vis-a-vis the prior estimates. Adjusted betas are obtained by taking an appropriately weighted average of the unadjusted and the a priori estimates of beta. Because the degree of adjustment depends on the estimated reliability of a priori assumptions, no change is made in the betas if the a priori estimates prove to be useless.

Statistical theory indicates that under certain conditions those modifications can never result in worse predictions than those indicated by the unadjusted betas. Testing has shown that the method is as effective as that suggested by Blume in improving the predictability of betas. That approach does not rely on the assumption that the ex post and ex ante relation between betas in one set of time periods will be

the same as those in the preceding set, because no inputs except the regressions used to compute the raw betas are required. The adjustment based on the Bayes approach has been implemented into the Merrill Lynch beta service.

A priori assumptions need not be so simple as that presented above. One could, for example, assume that only betas of stocks trading on the same exchange or stocks of companies in the same industry are approximately equal. An advantage of using more sophisticated a priori estimates is that when prior assumptions are more realistic, more effective adjustments are obtained. Further research will examine the feasibility of using more complex priors.

PROJECTIONS OF PORTFOLIO RETURNS

An important function of beta coefficients is to predict future portfolio returns on the basis of projected market or S & P 500 returns. According to the Sharpe-Lintner capital-asset-pricing model, total portfolio return (price + dividend returns) is given by: $Y-R = B(X-R)$

where:

Y = Return of fund
R = Risk-free rate
B = Beta of fund
X = Market return

Thus, the effect of a beta applies only to returns above or below the risk-free rate. For example, a portfolio with a beta of 1.5 should return 12% in a year in which the market is up by 10% and the risk-free rate is 6%. The excess return of the market (the difference between actual market return and the risk-free rate) of 4% has been multiplied by the beta of 1.5. The portfolio would then have an excess return of 6%, for a total return of 12%. In a period when the market return is 4% and the risk-free rate is 6%, the 1.5 beta portfolio should return 3% (the excess return of -2% multiplied by 1.5 gives the portfolio an excess of -3%, for a total return of 3%).

Because theory has indicated and testing has shown that the use of price returns instead of total returns has almost no effect on calculated betas, there is no problem in applying those betas directly to the capital-asset-pricing model. All calculations are based on betas that have been adjusted for regression bias, unless otherwise specified by the user.

Because total return is the sum of price return and dividend return for both the portfolio and S & P 500 one can estimate long-term price returns on the portfolio on the basis of projected price returns on the S & P 500 one can estimate long-term price returns on the portfolio on the basis of projected price returns on the S & P 500 in the following manner:

1. To obtain the projected total return on the S & P 500, add its expected dividend return to the projected price returns.
2. Apply the capital-asset-pricing model (using projected total return on the S & P 500) to estimate total portfolio return.
3. Subtract the expected portfolio dividend return from expected return to obtain the expected price return on the portfolio.

Rewriting the model (where the subscripts p and d refer to price and dividend returns)

$$Y_p + Y_d - R = B(X_p + X_d - R)$$

In the Merrill Lynch projections, the risk-free return is assumed to be 5% a year, unless otherwise specified by the user. Dividend return on the S & P 500 is assumed to be the current expected yield for that Index. The portfolio's annual dividend rate is supplied by the user. If the projected time period is other than one year, both the annual dividend and risk-free rates are adjusted appropriately. For users not supplying dividend and horizon information, Merrill Lynch provides short-term projections based on total return for the market. The projections are for total portfolio return and incorporate no risk-free rate assumption.

DIVERSIFICATION

Both portfolio beta and portfolio specific return are merely dollar-weighted averages of the corresponding values of the component stocks. Because specific returns for a group of individual stocks tend to cancel one another, most of the specific risk in a portfolio is diversified away. That is not true for market risk, because all stocks are affected by market fluctuations. Consequently, market risk is the dominant source of risk for portfolios.

Because beta coefficients for portfolios are only useful if they aid in predicting future results,

the Merrill Lynch service provides a statistic that gauges the effect of the various holdings on the total portfolio and estimates the level of portfolio diversification. The greater the diversification, the more closely the portfolio should approximate the risk-adjusted projections implied by its estimated beta.

It can be shown that the specific risk (variance in specific returns) is given by

$$\sum P_i^2 \sigma_i^2$$

where:

- = Proportion of portfolio in stock
- = Residual standard deviation of stock

Mathematically, variance of specific returns in a portfolio is reduced because of squaring numbers less than 1. The measure of diversification is given by

$$D = \frac{\sigma^2}{\sum P_i^2 \sigma_i^2}$$

where: σ = Residual standard deviation of a typical stock.
 σ_i = The number of typical stocks in which one must invest equal numbers of dollars to obtain the same amount of diversification.

If, for example, a portfolio has diversification measure $D = 20$, diversification is equivalent to an investment of an equal number of dollars in each of 20 typical stocks. That measure allows for the fact that a portfolio with unequal numbers of dollars in each stock is usually not so well diversified as a portfolio with equal sums invested in each of the same securities. The diversification measure also takes into account the fact that portfolios of stocks having large residual standard deviation will be less diversified than are portfolios having stocks with more moderate residual standard deviations.

In the Merrill Lynch service, the stocks that make up the S & P 500 are used to determine the characteristics of "typical" stocks for the purpose of measuring diversification. The diversification measure is described in the article "Risk, Market Sensitivity and Diversification" by Professor William F. Sharpe, published in the January-February 1972 *Financial Analysts Journal*.

JOHN J. TARGIA, MANAGER
RESEARCH COMPUTER
SERVICES DEPARTMENT
(212) 637-7396

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BETAS AND THEIR REGRESSION TENDENCIES

MARSHALL E. BLUME*

I. INTRODUCTION

A PREVIOUS STUDY [3] showed that estimated beta coefficients, at least in the context of a portfolio of a large number of securities, were relatively stationary over time. Nonetheless, there was a consistent tendency for a portfolio with either an extremely low or high estimated beta in one period to have a less extreme beta as estimated in the next period. In other words, estimated betas exhibited in that article a tendency to regress towards the grand mean of all betas, namely one. This study will examine in further detail this regression tendency.¹

The next section presents evidence showing the existence of this regression tendency and reviews the conventional reasons given in explanation [1], [4], [5]. The following section develops a formal model of this regression tendency and finds that the conventional analysis of this tendency is, if not incorrect, certainly misleading. Accompanying this theoretical analysis are some new empirical results which show that a major reason for the observed regression is real non-stationarities in the underlying values of beta and that the so-called "order bias" is not of dominant importance.

II. THE CONVENTIONAL WISDOM

If an investor were to use estimated betas to group securities into portfolios spanning a wide range of risk, he would more than likely find that the betas estimated for the very same portfolios in a subsequent period would be less extreme or closer to the market beta of one than his prior estimates. To illustrate, assume that the investor on July 1, 1933, had at his disposal an estimate of beta for each common stock which had been listed on the NYSE (New York Stock Exchange) for the prior seven years, July 1926-June 1933. Assume further that each estimate was derived by regressing the eighty-four monthly relatives covering this seven-year period upon the corresponding values for the market portfolio.²

If this investor, say, desired equally weighted portfolios of 100 securities, he might group those 100 securities with the smallest estimates of beta together to form a portfolio. Such a portfolio would of all equally

* Professor of Finance, University of Pennsylvania. The author wishes to thank Professors John Bidersee and Harry Markowitz for their helpful comments and the Rodney L. White Center for financial support.

1. Quite apart from this regression tendency, it is reasonable to suppose that betas do change over time in systematic ways in response to certain changes in the structure of companies.

2. Such regressions were calculated only for securities with complete data. The relative for the market portfolio was measured by Fisher's Combination Link Relative [6].

weighted portfolios have the smallest possible estimated portfolio beta since an estimate of such a portfolio beta can be shown to be an average of the estimates for the individual securities [2, p. 169]. To cover a wide range of portfolio betas, this investor might then form a second portfolio consisting of the 100 securities with the next smallest estimates of beta, and so on.

Using the securities available as of June 1933, this investor could thus obtain four portfolios of 100 securities apiece with no security in common. Estimated over the same seven-year period, July 1926-June 1933, the betas for these portfolios³ would have ranged from 0.50 to 1.53. Similar portfolios can be constructed for each of the next seven-year periods through 1954 and their portfolio betas calculated. Table 1 contains these estimates under the heading "Grouping Period."

The betas for these same portfolios, but reestimated using the monthly portfolio relatives adjusted for delistings from the seven years following the grouping period, illustrate the magnitude of the regression tendency.⁴ Whereas the portfolio betas as estimated, for instance, in the grouping period 1926-33 ranged from 0.50 to 1.53, the betas as estimated for these same portfolios in the subsequent seven-year period 1933-40 ranged only from 0.61 to 1.42. The results for the other periods display a similar regression tendency.

An obvious explanation of this regression tendency is that for some unstated economic or behavioral reasons, the underlying betas do tend to regress towards the mean over time.⁵ Yet, even if the true betas were constant over time, it has been argued that the portfolio betas as estimated in the grouping period would as a statistical artifact tend to be more extreme than those estimated in a subsequent period. This bias has sometimes been termed an order or selection bias.

The frequently given intuitive explanation of this order bias [1], [4], [5], parallels the following: Consider the portfolio formed of the 100 securities with the lowest estimates of beta. The estimated portfolio beta might be expected to understate the true beta or equivalently be expected to be measured with negative error. The reason the measurement error might

3. These portfolio betas were derived by averaging the 100 estimates for the individual securities. Alternatively, as [2] shows, the same number would be obtained by regressing the monthly portfolio relatives upon the market index where the portfolio relatives are calculated assuming an equal amount invested in each security at the beginning of each month.

4. These portfolio betas were calculated by regressing portfolio relatives upon the market relatives. The portfolio relatives were taken to be the average of the monthly relatives of the individual securities for which relatives were available. These relatives represent those which would have been realized from an equally-weighted, monthly rebalancing strategy in which a delisted security is sold at the last available price and the proceeds reinvested equally in the remaining securities. This rather complicated procedure takes into account delisted securities and therefore avoids any survivorship bias. In [3], the securities analyzed were required to be listed on the NYSE throughout both the grouping period and the subsequent period, so that there was a potential survivorship bias. Nonetheless, the results reported there are in substantive agreement with the results in Table 1.

5. If the betas are continually changing over time, an estimate of beta as provided by a simple regression must be interpreted with considerable caution. For example, if the true beta followed a linear time trend, it is easily shown that the estimated beta can be interpreted as an unbiased estimate of the beta in the middle of the sample period. A similar interpretation would not in general hold if, for instance, the true beta followed a quadratic time trend.